

Space Shuttle Mission Chronology 1999

1). STS-96

2). STS-93

3). STS-103

(In chronological order)

STS-96 (2nd International Space Station Flight)

Discovery

Pad B

94th Shuttle mission
26th flight OV-103
48th KSC landing

Crew:

Kent V. Rominger, Commander (4th space flight)
Rick D. Husband, Pilot (1st)
Ellen Ochoa, Mission Specialist (3rd)
Tamara E. Jernigan, Mission Specialist (5th)
Daniel T. Barry, Mission Specialist (2nd)
Julie Payette, Mission Specialist, Canadian Space Agency (1st)
Valery Ivanovich Tokarev, Mission Specialist, Russian Space Agency (1st)

Orbiter Preps (move to):

OPF -- Nov. 7, 1998
VAB -- April 15, 1999
Pad -- April 23, 1999
Return to VAB -- May 16, 1999 (Rollback due to hail damage)
Return to Pad -- May 20, 1999

Launch:

May 27, 1999, 6:49:42 a.m. EDT. The originally scheduled launch of Discovery on May 20 was postponed because of hail damage sustained May 8 by the external tank while on the pad. It was determined that some of the tank's foam insulation could not be reached for repairs with the orbiter on the pad. The orbiter was returned to the VAB, and inspections revealed more than 650 divots in the tank's outer foam. Workers repaired about 460 critical divots over four days to minimize ice formation prior to launch. The countdown proceeded smoothly, with the only concern the presence of a sailboat in the solid rocket booster recovery area. As planned, launch managers determined the exact orbital location of the International Space Station during the countdown's T-9-minute built-in hold. The decision was then made to launch Discovery at 6:49 a.m. EDT to achieve optimum Shuttle system performance and to accommodate Shuttle-Space Station docking activities.

Landing:

June 6, 1999, 2:02:43 a.m. EDT , Runway 15, Kennedy Space Center, Fla.
Rollout distance: 8,866 feet. Rollout time: 56 seconds. Mission duration: nine days, 19 hours, 13 minutes, 57 seconds. Landed on orbit 154. Logged 3.8 million statute miles. Landed on first opportunity at KSC, marking 18th consecutive landing in Florida and 25th in the last 26 missions.

Mission Highlights:

All major objectives were accomplished during the mission. On May 29, Discovery made the first docking to the International Space Station (ISS). Rominger eased the Shuttle to a textbook linkup with Unity's Pressurized Mating Adapter #2 as the orbiter and the ISS flew over the Russian-Kazakh border.

The 45th space walk in Space Shuttle history and the fourth of the ISS era lasted 7 hours and 55 minutes, making it the second-longest ever conducted. Jernigan and Barry transferred a U.S.-built crane called the Orbital Transfer Device, and parts of the Russian crane

Strela from the Shuttle's payload bay and attached them to locations on the outside of the station. The astronauts also installed two new portable foot restraints that will fit both American and Russian space boots, and attached three bags filled with tools and handrails that will be used during future assembly operations. The cranes and tools fastened to the outside of the station totaled 662 pounds.

Once those primary tasks were accomplished, Jernigan and Barry installed an insulating cover on a trunnion pin on the Unity module, documented painted surfaces on both the Unity and Zarya modules, and inspected one of two Early Communications System (E-Com) antennas on the Unity.

During the incursion inside the ISS, Barry and Husband replaced a power distribution unit and transceiver for E-Com in the Unity module, restoring that system to its full capability. Payette and Tokarev replaced 18 battery recharge controllers in the Russian-built Zarya module, and Barry and Tokarev also installed a series of "mufflers" over fans inside Zarya to reduce noise levels in that module. The mufflers caused some air circulating duct work to collapse, and Rominger sent down a video inspection of the mufflers.

The crew transferred 3,567 pounds of material – including clothing, sleeping bags, spare parts, medical equipment, supplies, hardware and about 84 gallons of water – to the interior of the station. The astronauts also installed parts of a wireless strain gauge system that will help engineers track the effects of adding modules to the station throughout its assembly, cleaning filters and checking smoke detectors. Eighteen items weighing 197 pounds were moved from the station to Discovery for a return to Earth.

The astronauts spent a total of 79 hours, 30 minutes inside the station before closing the final hatch on the orbiting outpost. Rominger and Husband commanded a series of 17 pulses of Discovery's reaction control system jets to boost the station to an orbit of approximately 246 by 241 statute miles. After spending 5 days, 18 hours and 17 minutes linked to the station, Discovery undocked at 6:39 p.m. EDT as Husband fired Discovery's jets to move to a distance of about 400 feet for 2 ½ lap flyaround. The crew used the flyaround to make a detailed photographic record of the ISS.

After the flyaround, mission specialist Payette deployed the STARSHINE satellite from the orbiter's cargo bay. The spherical, reflective object entered an orbit two miles below Discovery. The small probe became instantly visible from Earth as part of a project allowing more than 25,000 students from 18 countries to track its progress.

Other payloads included the Shuttle Vibration Forces experiment and the Integrated Vehicle Health Monitoring HEDS Technology Demonstration.

STS-93 (Chandra X-ray Observatory)

Columbia

Pad B

95th Shuttle mission

26th flight OV-102

48th KSC landing

Crew:

Eileen M. Collins, Commander (3rd space flight)

Jeffrey S. Ashby, Pilot (1st)

Steven A. Hawley, Mission Specialist (5th)

Catherine G. "Cady" Coleman, Mission Specialist (2nd)
Michel Tognini, Mission Specialist (2nd)

Orbiter Preps:

OPF - May 4, 1998
VAB - Feb. 10, 1999 (Temporary storage)
OPF - April 15, 1999
VAB - June 2, 1999
Pad 39 B - June 7, 1999

Launch:

July 23, 1999, at 12:31:00 a.m. EDT. The originally scheduled launch on July 20 was scrubbed at about the T-7 second mark in the countdown. Following a virtually flawless countdown, the orbiter's hazardous gas detection system indicated a 640 ppm concentration of hydrogen in Columbia's aft engine compartment, more than double the allowable amount. System engineers in KSC's Firing Room No. 1 noted the indication and initiated a manual cutoff of the ground launch sequencer less than one-half second before the Shuttle's three main engines would have started. Following preliminary system and data evaluation, launch managers determined the hydrogen concentration indication was false. A second launch attempt 48 hours later was scrubbed due to weather at KSC. A 24-hour turnaround was initiated and the third launch attempt succeeded with Columbia lifting off the pad on July 23.

During the countdown for launch on the third attempt, a communications problem occurred that resulted in the loss of the forward link to Columbia. The problem was corrected at the Merritt Island Launch Area (MILA) ground facility and communications was restored. As a result of this problem, the time of the planned launch was slipped seven minutes to 12:31 a.m. EDT on July 23.

About 5 seconds after liftoff, flight controllers noted a voltage drop on one of the shuttle's electrical buses. Because of this voltage drop, one of two redundant main engine controllers on two of the three engines shut down. The redundant controllers on those two engines -- center and right main engines -- functioned normally, allowing them to fully support Columbia's climb to orbit.

The orbit attained, however, was 7 miles short of that originally projected due to premature main engine cutoff an instant before the scheduled cutoff. This problem was eventually traced to a hydrogen leak in the No. 3 main engine nozzle. The leak was caused when a liquid oxygen post pin came out of the main injector during main engine ignition, striking the hotwall of the nozzle and rupturing three liquid hydrogen coolant tubes.

The orbiter eventually attained its proper altitude and successfully deployed the Chandra X-ray Observatory into its desired orbit.

Landing:

July 27, 1999 at 11:20:37 p.m. EDT. Runway 33, Kennedy Space Center, Fla. Rollout distance 6,851 feet. Rollout time: 43.3 seconds. Mission duration: 4 days, 22 hours, 49 minutes, 37 seconds. Landed on orbit 80, logging 1.8 million miles. It marked the 12th nighttime landing in the shuttle program and the 7th at Kennedy Space Center.

Mission Highlights:

STS-93 was the first mission in Space Shuttle history to be commanded by a woman, Commander Eileen Collins. Also, this was the shortest scheduled mission since 1990.

On the first day of the scheduled five-day mission, the Chandra X-ray Observatory was deployed from Columbia's payload bay. Chandra's two-stage Inertial Upper Stage (IUS) propelled the observatory into a transfer orbit of 205 miles by 44,759 miles in altitude.

Following the second IUS burn, Chandra's solar arrays were deployed and the IUS separated from the observatory as planned.

During the rest of the mission secondary payloads and experiments were activated. The Southwest Ultraviolet Imaging System (SWUIS) was used aboard Columbia to capture ultraviolet imagery of Earth, the Moon, Mercury, Venus and Jupiter.

Astronauts monitored several plant growth experiments and collected data from a biological cell culture experiment. They used the exercise treadmill and the Treadmill Vibration Information System to measure vibrations and changes in microgravity levels caused by on-orbit workouts.

High Definition Television equipment was tested for future use on both the shuttle and the International Space Station to conform to evolving broadcasting industry standards for television products.

STS-103 (Third Hubble Space Telescope Servicing Mission)

Discovery

Pad B

96th Shuttle mission
27th flight OV-103
49th KSC landing

Crew:

Curtis L. Brown Jr., Commander (6th space flight)
Scott J. Kelly, Pilot (1st)
Steven L. Smith, Payload Commander (3rd)
C. Michael Foale, Mission Specialist (5th)
John M. Grunsfeld, Mission Specialist (3rd)
Claude Nicollier, Mission Specialist (4th)
Jean-Francois Clervoy (3rd)

Orbiter Preps:

OPF - 06/06/99
VAB - 11/04/99
Pad 39 B - 11/13/99

Launch:

Dec. 19, 1999, at 7:50:00 p.m. EST. Discovery faced nine delays and scrubs, some mechanical and some due to the weather, before launching successfully.

Before facing those postponements, the third Hubble Space Shuttle servicing mission had been advanced in the mission schedule. The servicing mission was originally scheduled for June 2000, but when the third of Hubble's six gyroscopes failed, the mission was split into two separate missions. The first mission, STS-103, was scheduled for Oct. 14 with the second mission to follow in 2001. (Hubble needs at least three of its six gyroscopes to be functioning to enable the telescope to point precisely at distant astronomical targets for scientific observation.)

In mid-August Shuttle managers decided to extend wiring inspections and maintenance across the Shuttle fleet after wiring problems were detected aboard Columbia. That orbiter was inspected and determined to have wiring problems after an irregularity occurred during the launch of STS-93 on July 23, 1999. Following inspections of Discovery, a new target launch date of no earlier than Oct. 28 was announced (first launch delay).

Because of the amount of wiring repairs needed, the planning date was shifted to no earlier than Nov. 19 (second delay). Shuttle managers decided to preserve the option to launch either STS-103 or STS-99, the Space Radar Topography Mission, first.

On Nov. 13, a fourth gyroscope on Hubble failed and the observatory was put into "safe mode," a state of dormancy in which the telescope aims itself constantly at the sun to provide electrical power to its systems.

As repairs to Discovery came to a close, launch was targeted for Dec. 2. The launched date was put under review after a half-inch-long drill bit was discovered to be lodged in main engine No. 3. A new launch date of Dec. 6 was set (third delay). Rollout to the pad proceeded and Discovery's main engine No. 3 was replaced while the orbiter was on the pad.

After Discovery reached the pad, additional damaged wiring, which was found in an umbilical between the orbiter and the external tank, was detected and a new launch date of Dec. 9 was set to allow for repair and testing (fourth delay). The launch was then reset to Dec. 11 (fifth delay). The new target date allowed KSC workers to observe the Thanksgiving Holidays.

The mission was again put on hold after a dented main propulsion system line which carries liquid hydrogen fuel for the Shuttle main engines was found during closeout inspections of Discovery's engine compartment. A new target date of no earlier than December 16 was set (sixth delay).

By Dec. 13, workers at Launch Pad 39B had completed inspections and leak checks on Shuttle Discovery's replaced liquid hydrogen recirculation line that was replaced and the target date confirmed to be Dec. 16.

On Tuesday, Dec. 14, 1999, the launch countdown for STS-103 began on schedule at 1:30 a.m. Later that day during routine inspections of the external tank's pressure lines, a suspect weld was detected. To ensure that the proper welding materials and procedures were used, a thorough review of process and paperwork used during the fabrication of the lines was conducted. It was determined that the same manufacturer performed welds on the 17-inch propellant feed lines and struts in the AFT engine compartment when Discovery was constructed. A 24 -hour delay was called to give the Shuttle team time to review the manufacturing inspection records for those lines as well. It was determined the welds were correctly made and the launch was rescheduled to Dec. 17 (seventh delay).

On Dec. 17, with an 80 percent chance of unfavorable weather, external tank cryogenic loading was started at 11:29 a.m. EST. Tanking operations were complete at 3:00pm EST. The launch countdown proceeded to the T-minus 9 minute mark and held due to weather constraints. At 8:52pm EST the launch director scrubbed the launch due to violations of weather launch commit criteria and the launch was rescheduled to Dec. 18 (eighth delay).

Due to the prediction of poor weather on Dec. 18, the mission management team decided to preserve a launch option and rescheduled Discovery's launch from Dec. 18 to Dec. 19 at 7:50pm EST (ninth delay).

On Dec. 19, 1999, the weather outlook was favorable, so Shuttle managers decided to proceed with the STS-103 launch countdown. The Shuttle launched on time at the beginning of the 42 minute window.

To ensure that all flight and ground systems were secured for the transition to Year 2000, the mission was shortened from 10 days to 8 days.

Landing:

Dec. 27, 1999 at 7:01:34 p.m. EST. Runway 33, Kennedy Space Center, Fla. Rollout distance 7,005 feet. Rollout time: 47 seconds. Mission duration: 7 days, 23 hours, 10 minutes, 47 seconds. Landed on orbit 119, logging more than 3.267 million miles. It marked the 13th nighttime landing in the shuttle program and the 8th at Kennedy Space Center.

Mission Highlights:

STS-103 restored the Hubble Space Telescope to working order and upgraded some of its systems, allowing the decade-old observatory to get ready to begin its second scheduled decade of astronomical observations.

The first few days of the 8-day mission, the crew prepared for the rendezvous and capture of the Hubble Space Telescope and the three maintenance spacewalks to follow. After a 30-orbit chase. Commander Brown and Kelly maneuvered the orbiter to a point directly beneath Hubble, then moved upward toward it. Mission Specialist Clervoy grappled Hubble using the orbiter's robotic arm and placed it on the Flight Support System in the rear of Discovery's cargo bay.

EVA No. 1: Mission Specialists Steven Smith and John Grunsfeld conducted the mission's first spacewalk. The two made numerous repairs, including replacing the telescope's three Rate Sensor Units – each containing two gyroscopes. They also installed six Voltage/Temperature Improvement Kits between Hubble's solar panels and its six 10-year-old batteries. The kits, the size of cell telephones, were designed to prevent any overheating or overcharging of those batteries. A few minor objectives were left undone, such as taking close-up photos of the Voltage/Temperature Improvement Kits. The 8-hour, 15-minute space walk was second to the longest space walk from Endeavour on STS-49 in May 1992. A few minor problems Specialist helped account for the length of the space walk. The astronauts had difficulty in removing one of the old RSUs, and opening valves and removing caps on the Near Infrared Camera and Multi-Object Spectrometer. The tasks were eventually completed.

EVA No. 2: During the mission's second space walk, Mission Specialists Michael Foale and Claude Nicollier installed a new advanced computer – 20 times faster than – and a new, 550-pound fine guidance sensor. This 8-hour, 10 minute space walk was the third longest in history. With all major activities accomplished, controllers reported that power was reaching both of the new pieces of equipment. "The brains of Hubble have been replaced," said Mission Specialist Grunsfeld. About 30 minutes later, Hubble began thinking with those new brains.

EVA No. 3: Smith and Grunsfeld again teamed up to make the mission's third and final space walk. Like the first two, it also lasted more than 8 hours, making it the fourth longest in history. The team installed a transmitter that sends scientific data from Hubble to the ground. It replaced one that failed in 1998. The astronauts used special tools developed for the task because transmitters, usually very reliable, were not designed to be replaced in orbit. Smith and Grunsfeld also installed a solid state digital recorder, replacing an older mechanical reel-to-reel

Hubble was released from Discovery's cargo bay on Christmas Day.

Mission STS-103 is only the second time in the Space Program that a crew has spent Christmas in space.

